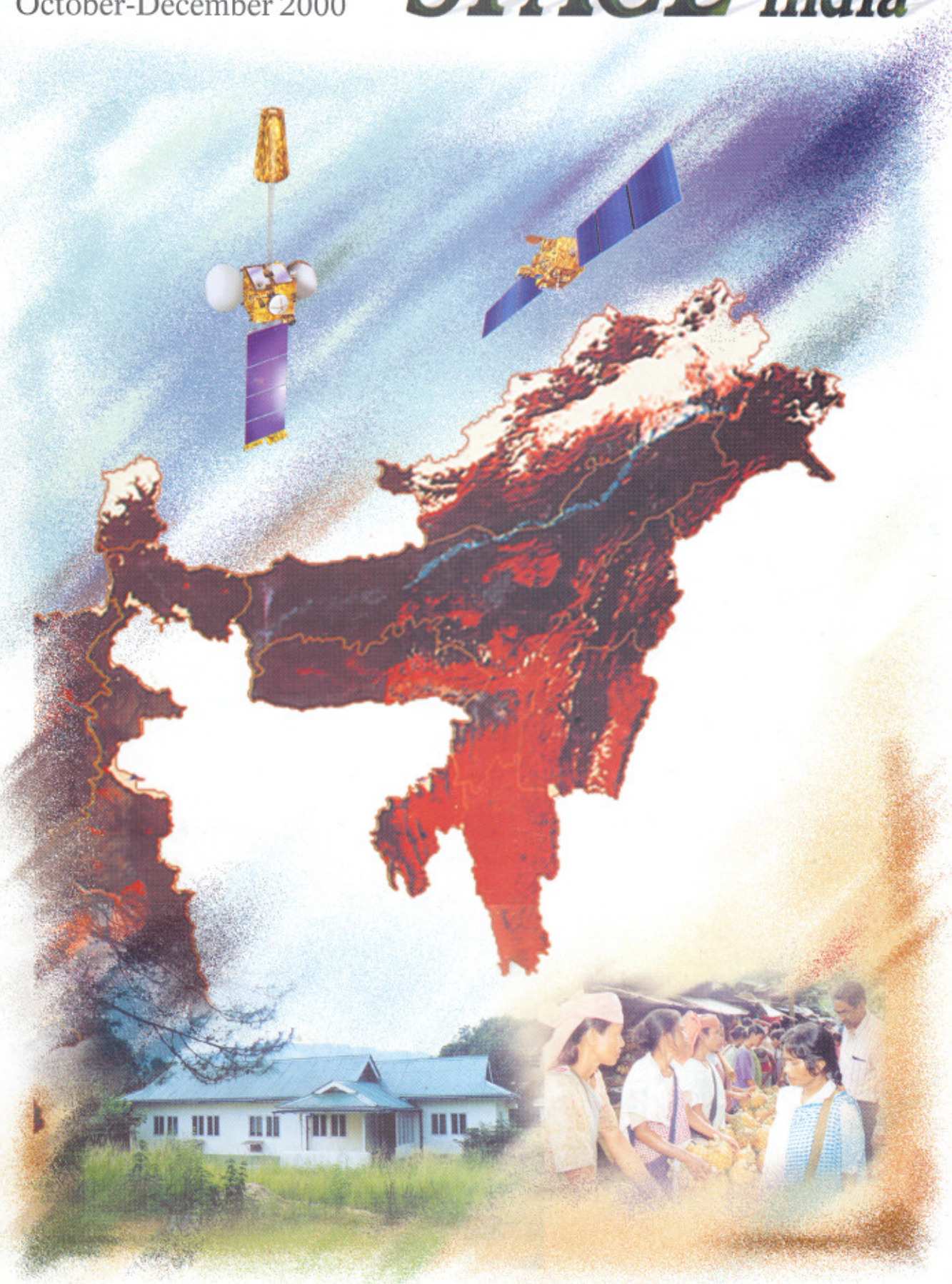
October-December 2000

SPACE india



INDIAN SPACE RESEARCH ORGANISATION

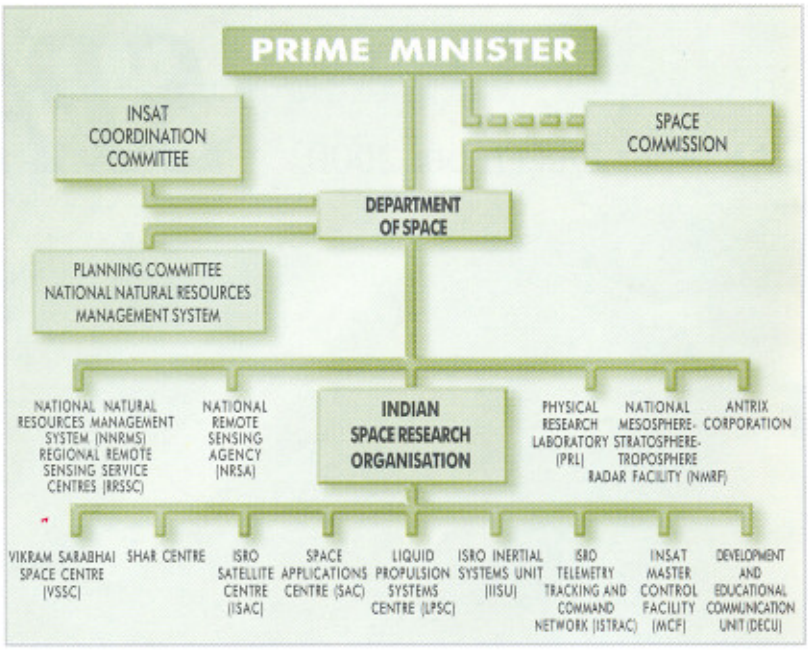
The Indian Space Programme

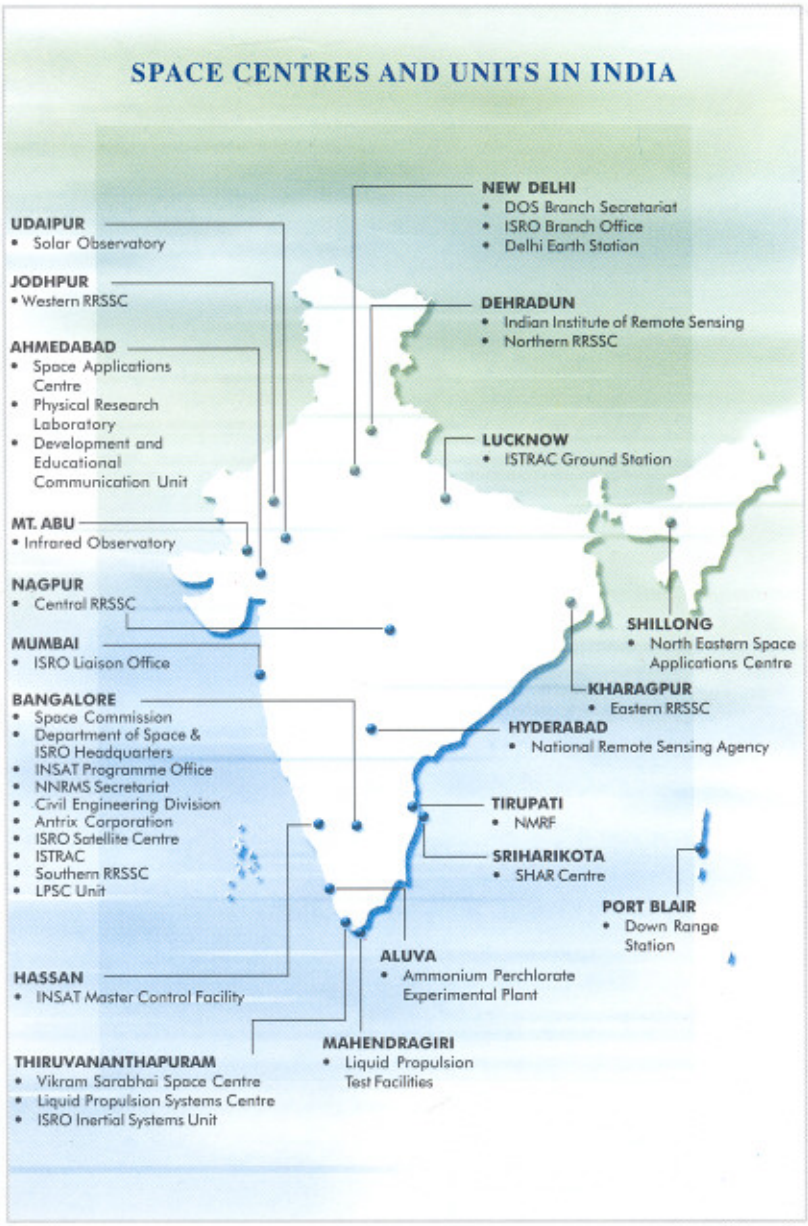
The setting up of the Thumba Equatorial Rocket Launching Station (TERLS) in 1963 marked the beginning of the Indian Space Programme. The Space Commission and the Department of Space (DOS) were established by the Government of India in 1972 to promote unified development and application of space science and technology for identified national objectives.

The Indian Space Programme is directed towards the goal of self reliant use of space technology for national development, its main thrusts being (a) satellite communications for various applications, (b) satellite remote sensing for resources survey and management, environmental monitoring and meteorological services and (c) development and operationalisation of indigenous satellite and launch vehicles for providing these space services.

The Indian Space Research Organisation (ISRO) is the research and development wing of DOS and is responsible for the execution of the national space programme. ISRO also provides support to universities and other academic institutions in the country for research and development projects relevant to the country's space programme.

Both the DOS and ISRO Headquarters are located at Bangalore. The development activities are carried out at the Centres and Units spread over the country.





Cover Page :
North-Eastern States for which a New Space Centre has been established.

SPACE india

October - December 2000

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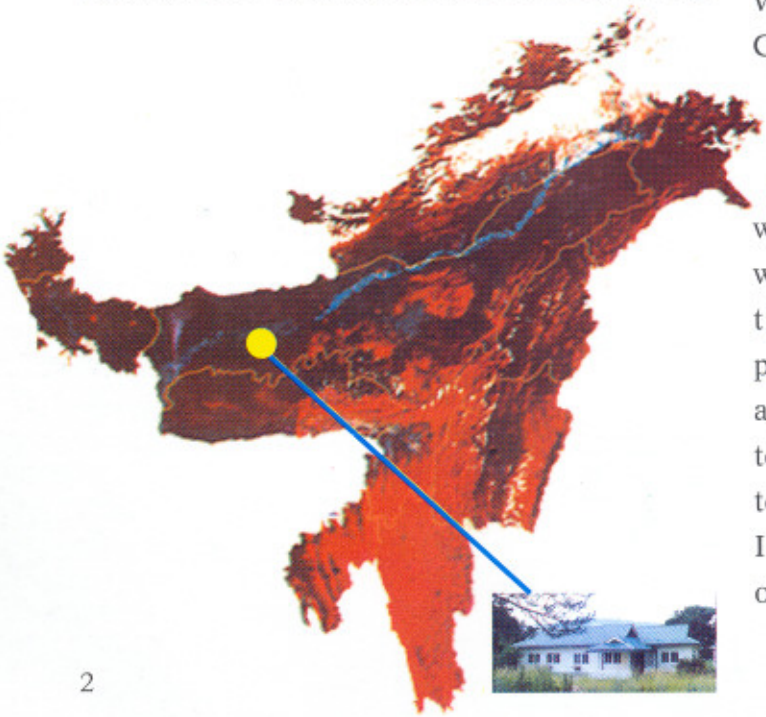
A New Space Centre is born

The Department of Space, jointly with the North Eastern Council, has set up the North Eastern Space Applications Centre (NE-SAC) to promote space technology and to ensure its benefit to the population in the north eastern region of India. NE-SAC came into being in Shillong on December 15, 2000. It will address natural resources management and developmental communications besides promoting space science research in the region.

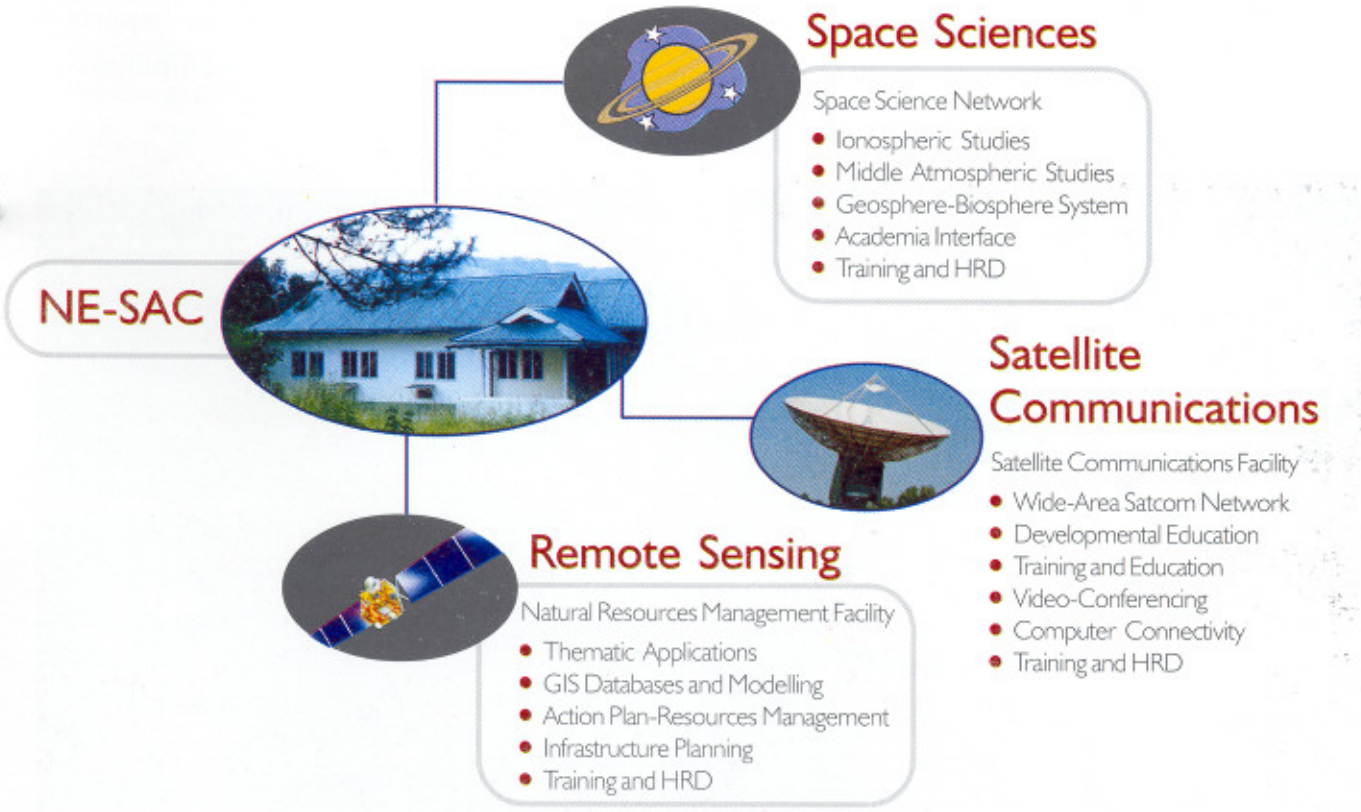
The North Eastern region of India, comprising eight hill states — Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Sikkim, Tripura and Nagaland — covers 2,62,000 sq km with a population of about 3.5 crore. The region has diverse cultural and social patterns and is rich in natural resources. Thick forests with a wide range of flora and fauna, numerous rivers including Brahmaputra, a temperate climate with copious rainfall and sparse and dispersed settlements are some of the characteristics of this region. River flooding and changes in the river courses and geo-morphology are common in the Brahmaputra valley. The highly undulating terrain gives rise to frequent landslides affecting communications. NE-SAC is intended to help the region for development of appropriate infrastructure for resources management and communications.

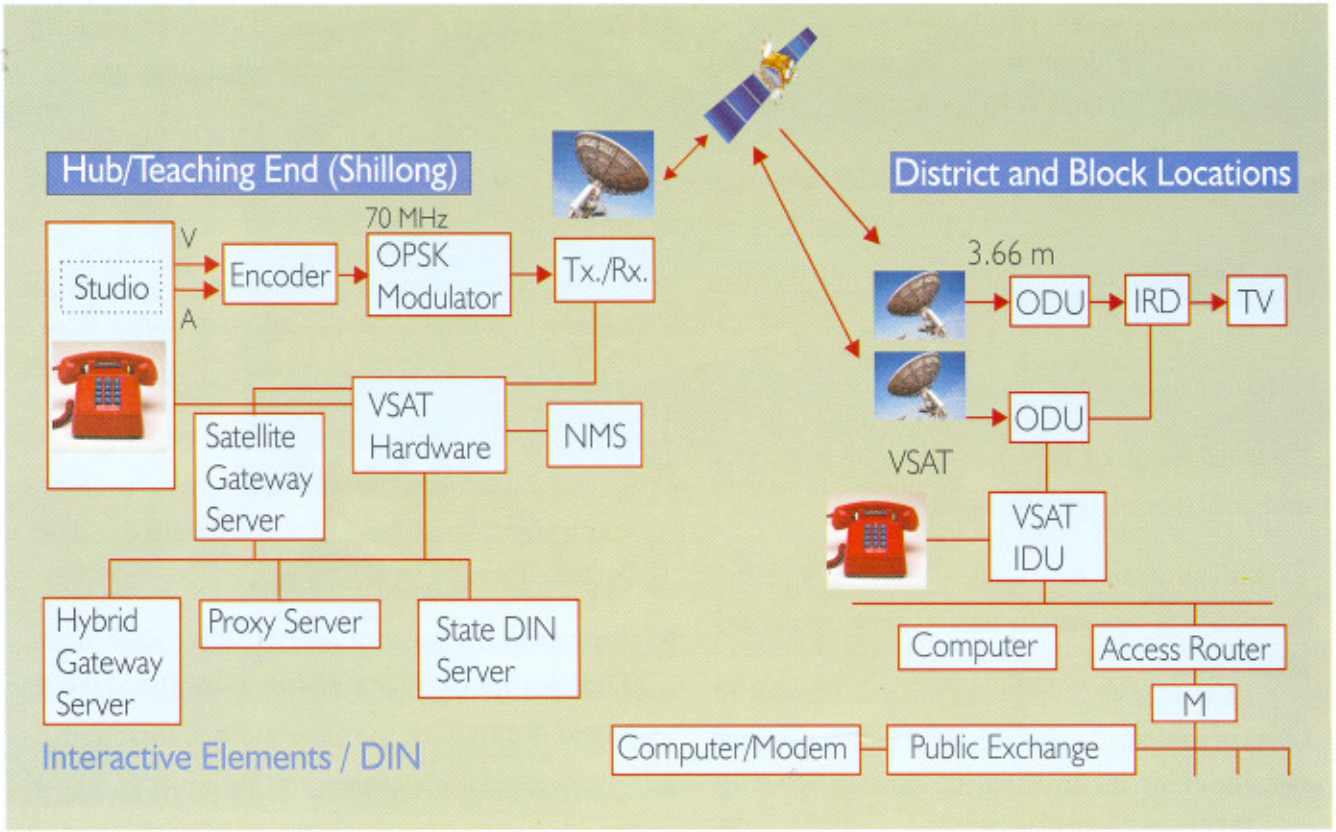


With active participation of all the State Governments in the region, it is envisaged that the requirements for developmental support would be translated into projects and programmes of NE-SAC and the results would benefit the region as a whole. The centre would also network with academic institutes in the region and promote educational and professional training activities in space applications, thus contributing to enhance the technical expertise and assimilation of the high technology of space. The close interaction with ISRO/DOS centres, Planning Commission and other central government agencies, will help in

channelising the space applications programme for a co-ordinated developmental process in the region. Some of the activities envisaged at NE-SAC are:

- Natural resources survey and development of resources management relevant to the region.
- Creation of a regional archive of remote sensing data for the region.
- Establishment of facilities for interpretation and analysis of remote sensing data.
- Establishment of GIS - based spatial information system to assist developmental planning.
- Organisation of human resources development in the field of remote sensing and GIS applications.
- Undertaking, promoting, guiding and coordinating research in remote sensing and GIS.
- Application of space based remote sensing techniques for geophysical phenomenon.
- Promotion of development communication involving concerned agencies in the areas of education, health, social welfare, etc.
- Provision of interactive distance education and training to teachers, village functionaries, social workers, healthcare workers, etc.
- Promotion of establishment of satellite based data networks for information exchange, video conferencing and internet access.
- Provision of training and Human Resources Development in satellite communication applications.
- Conducting research on environment monitoring and atmospheric sounding using radio and optical techniques.
- Research in ionospheric plasma and its interaction with magnetospheric processes.

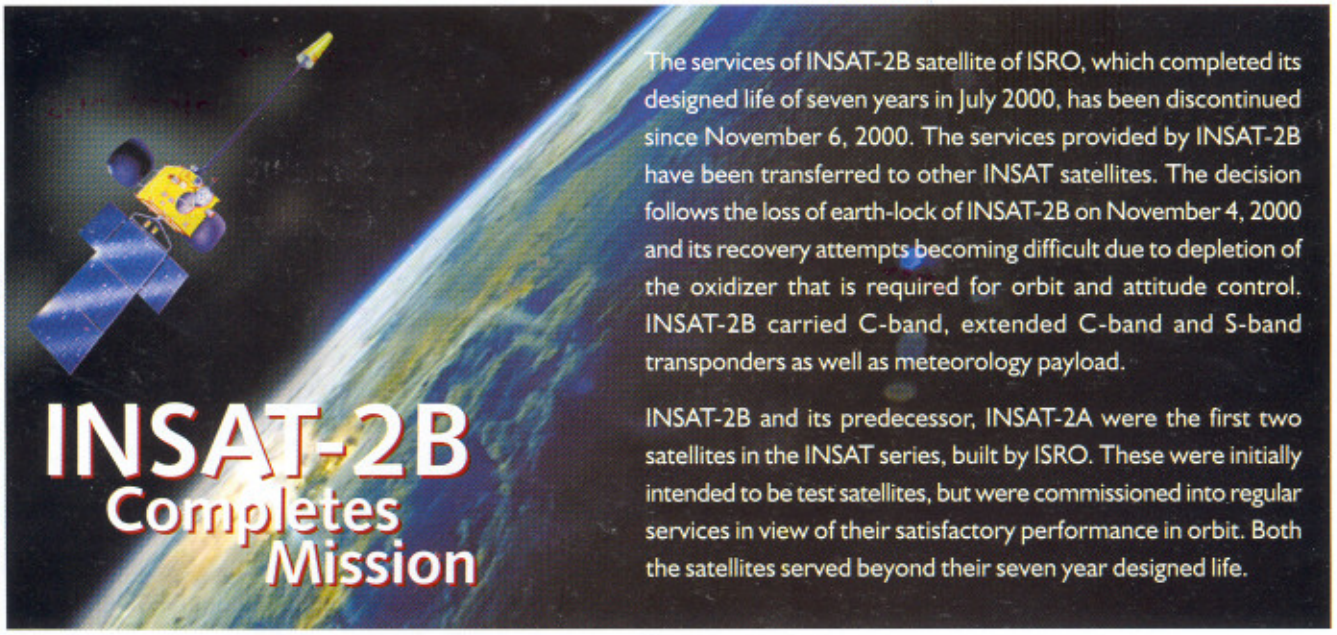




- Global change research by undertaking studies on land-air-sea interactions and establishing global change databases.

NE-SAC will have facilities like digital image analysis work stations, photogrammetry systems, digitisers and scanners, visual interpretation facilities, map library, studio, printers and plotters, GIS software, communication facilities including VSATs, video conferencing systems, ionospheric sounder, meteor radars, laboratory for optics and materials and satellite radio beacon experiment stations.

NE-SAC is expected to become an important catalyst for an accelerated development of North-Eastern region.



The services of INSAT-2B satellite of ISRO, which completed its designed life of seven years in July 2000, has been discontinued since November 6, 2000. The services provided by INSAT-2B have been transferred to other INSAT satellites. The decision follows the loss of earth-lock of INSAT-2B on November 4, 2000 and its recovery attempts becoming difficult due to depletion of the oxidizer that is required for orbit and attitude control. INSAT-2B carried C-band, extended C-band and S-band transponders as well as meteorology payload.

INSAT-2B and its predecessor, INSAT-2A were the first two satellites in the INSAT series, built by ISRO. These were initially intended to be test satellites, but were commissioned into regular services in view of their satisfactory performance in orbit. Both the satellites served beyond their seven year designed life.

ISRO Centres Come Closer with SPACENET

An INSAT-based closed user group communication network, SPACENET, that interconnects all ISRO Centres has been set up. SPACENET is a multimedia network using latest digital technology for analog signal transmission and various data compression techniques to transmit audio, video and data simultaneously using the same network.

SPACENET, implemented using Very Small Aperture Terminal (VSAT) network, is flexible in terms of providing Star or Mesh as well as Demand or Pre-assigned connectivity. The networking architecture provides easy expansion capability both in terms of adding new stations or incorporating additional facilities in the existing stations.

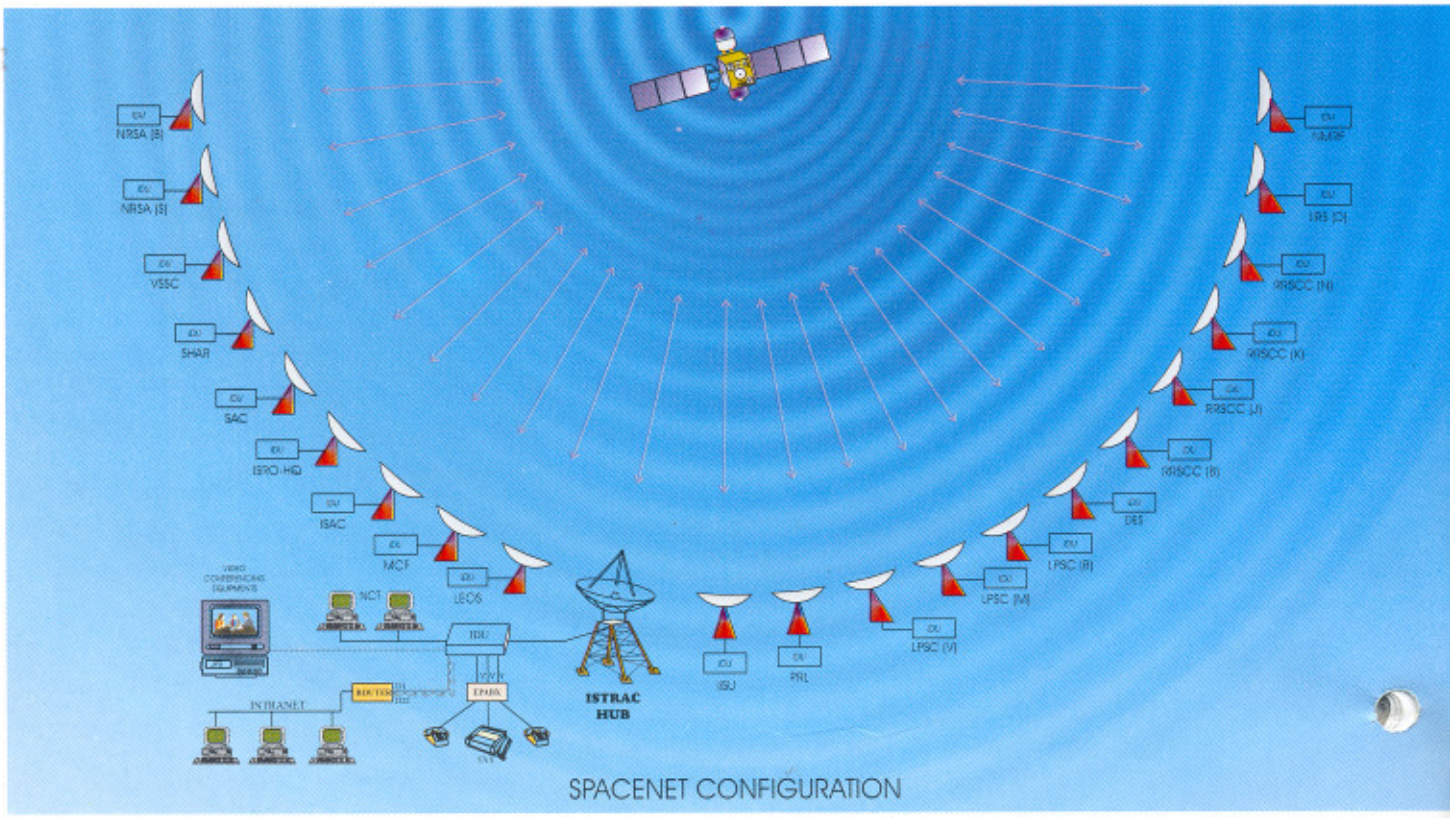
The unique feature of the network is that it can operate even with a satellite that is in an inclined orbit of up to three degrees with respect to the equatorial plane. Thus, INSAT satellites, which have been taken out of regular services due to their being in inclined orbit, can be used for SPACENET. Global Positioning System (GPS) receivers, installed at the stations help in accurate network time synchronisation, and correction of Doppler frequency shift due to the inclined orbit.

The central hub station is located at ISRO's Telemetry, Tracking and Command (ISTRAC) Network Station, Bangalore and the remote terminals at 21 different centres of ISRO. The hub station of the SPACENET has a 6.3 m diameter antenna with program tracking facility. Each remote station consists of a 3.8 m VSAT antenna with program tracking unit. The SPACENET uses (Single Channel Per Carrier) SCPC/DAMA (Demand Assigned Multiple Access) technology for Voice/Video conferencing and SCPC/PAMA (Pre-Assigned Multiple Access) technology for Intranet services.

In its full configuration, SPACENET provides voice, fax, electronic mail, video conferencing, computer to computer networking, File Transfer Protocol (FTP), telnet, web page access and hosting, bulletin board newsletter services, etc.

VOICE/FAX: Voice services are operated in DAMA mode and are having mesh connectivity. Exchanges at respective centres/units are directly connected to Flexi Dama unit with Type V four wire E&M interface. Three digit numbering scheme is used to access the different stations. Toll quality 9.6 kbps Vector Adaptive Predictive Coding (VAPC) with ½ rate Forward Error Correction (FEC) is selected for Voice. Voice card automatically identifies the Fax tones and bypasses voice CODEC while transmitting fax. It also supports inband data transmission at 9.6 kbps.

INTRANET SERVICES: Internet services among all centres/units are provided by using 64 kbps data pipe. It is operated in Star mode and routing is done at hub station by using Multiprotocol router. INTRANET uses the standard well-defined technologies available in Internet through the corporate LAN. Any individual or group can interact with another individual or group via E-mail, FTP and Web



SPACENET CONFIGURATION

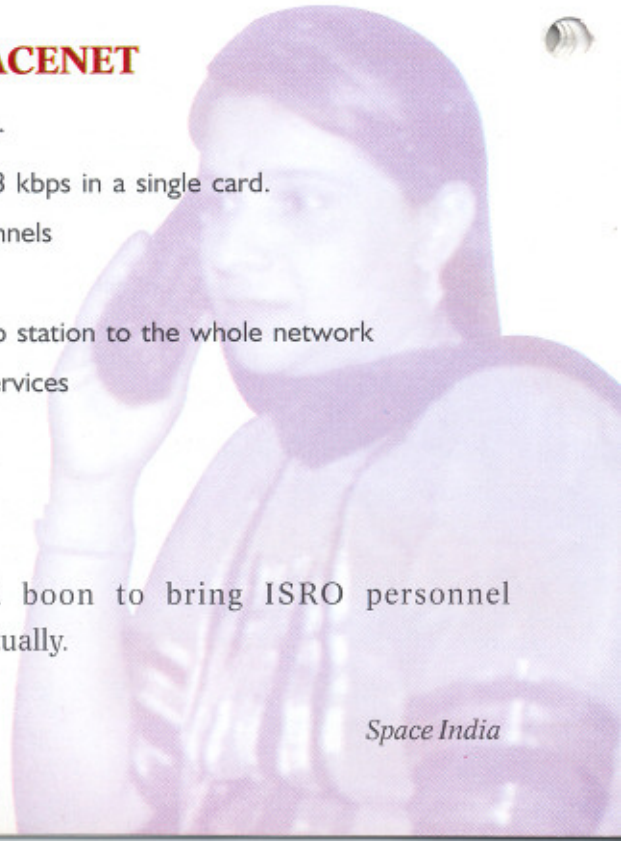
browsing. Bulk data transfer between any two locations is also available.

VIDEO CONFERENCE SERVICE (VCS): SPACENET provides group video conferencing facility, which allows personnel at different centres/units exchange information. It also allows technical presentations and discussions in real time. The system is capable of providing group conferencing for about 30 participants at each end. Presentation can be made using printed/hand written materials, etc, through the dedicated Document Camera available with each system. System can be controlled with an infra-red keypad and Look At Me (LAM) buttons for instantaneous response of the speaker.

SPACENET provides an infrastructure for offering various services within ISRO and is indeed a boon to bring ISRO personnel closer virtually.

Salient Features of SPACENET

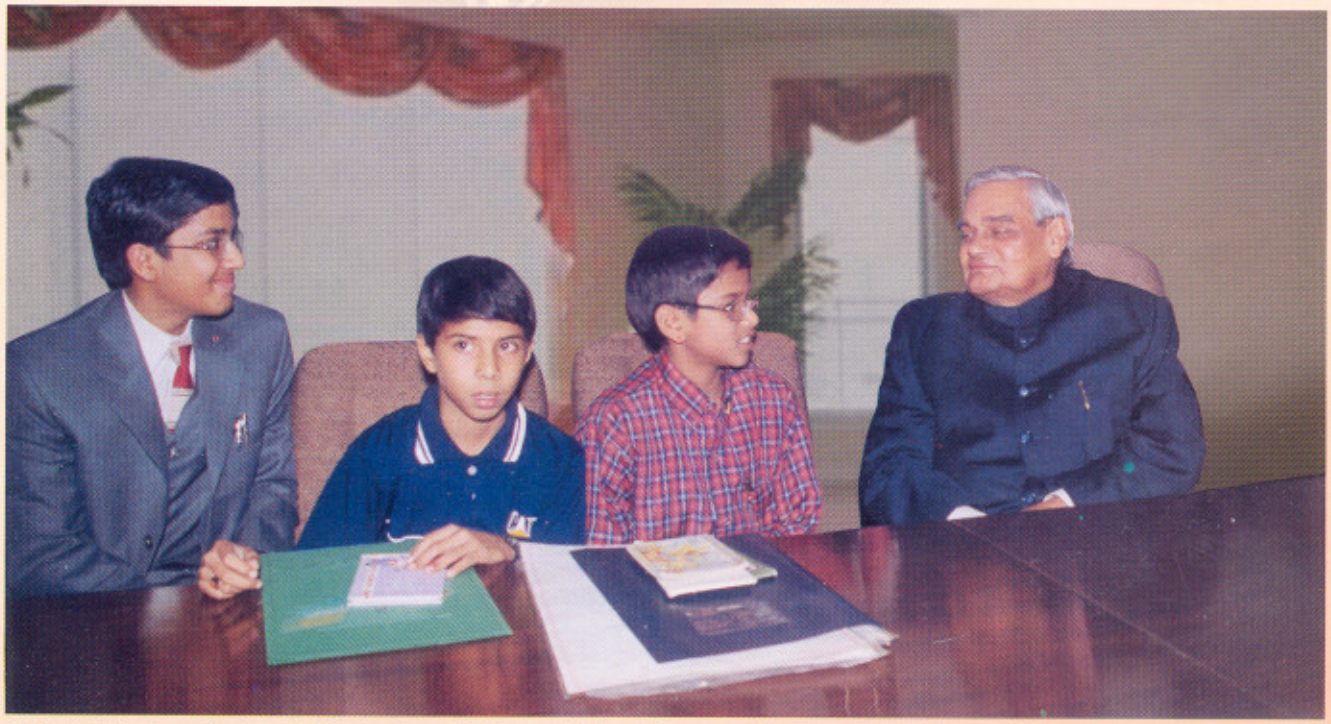
- Pilotless network operation due to integrated GPS receiver
- Supports synchronous data with speed of 9.6 kbps to 2048 kbps in a single card.
- Supports multiple TDM/TDMA outbound and inbound channels
- Less than 3 seconds for call set up
- Supports downloading of up-graded firmware from the hub station to the whole network
- Flexible frequency allocation for the various SPACENET services
- Video broadcasting facility through VCS
- Scheduler operation for Video / Data transmissions



Prime Minister Meets Indian Boys Selected Under Mars Mission Training

The Prime Minister, Mr Atal Bihari Vajpayee met in New Delhi on December 6, 2000, the three students, 15-year old Shaleen Rajendra Hartalka from Udaipur, 13-year old Tanmay Sanjay Khirwadkar of Nagpur and 10-year old Vikas Sarangadhara of Bangalore, who have been selected by the Planetary Society, USA, to serve on the Red Rover Goes to Mars Mission Training (*see Space India July-Sept 2000*). Smt Vasundhara Raje, Minister of State for Space, was also present.

The Prime Minister congratulated the three students who are among the nine selected from more than 10,000 finalists from all over the world to participate in this mission. He said that their achievement is a clear indication of the potential that exists in the country to undertake research in advanced scientific fields like astronomy. He appreciated the efforts of ISRO, the national coordinator and other institutions, for the efforts in selecting the students from India. The Prime Minister added that, with modern facilities for astronomy including the recently set up Giant Meter-wave Radio Telescope (GMRT) at Pune and the Optical Telescope at Hanle near Ladakh, there are exciting and challenging opportunities for the students to pursue basic space research in the country. He also added that while India has achieved a level of pre-eminence in the world in the modern endeavours of space research, the future will unfold new opportunities with our scientists already dreaming to establish a state of the art multi-wave length observatory called ASTROSAT to conduct front-ranking research in astronomy and undertake new endeavours in planetary exploration. The Prime Minister stressed that the students should be made aware of these opportunities and be helped to make judicious choice of their careers; those with the right aptitude for research should be encouraged to pursue such careers.



(L to R) Shaleen Rajendra Hartalka of Udaipur, Vikas Sarangadhara of Bangalore and Tanmay Sanjay Khirwadkar of Nagpur with the Prime Minister, Mr Atal Bihari Vajpayee

WORLD SPACE WEEK

ISRO Joined the world space community in celebrating the World Space Week from October 4 to 10, 2000. As a part of the celebration, ISRO organized a video conference on tele-medicine on October 6, 2000 linking Antariksh Bhavan, the Headquarters of ISRO at Bangalore and INSAT-Master Control Facility (MCF) at Hassan in Karnataka via INSAT Satellite, bringing together several specialist doctors in Bangalore and a number of doctors at Hassan. A demonstration of cost-effective equipment for tele-medicine was also part of the programme. MCF also observed the week arranging exhibitions and lectures.

Lectures by eminent persons on space themes marked the celebrations in the various ISRO Centres. A philately exhibition, depicting a rare collection of stamps issued all over the world on space themes were organized at Antariksh Bhavan and ISRO Satellite Centre.

Celebration of World Space Week is one of the recommendations of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE-III) held in Vienna in July 1999. The objective is to increase the awareness of the society about the benefits of peaceful uses of space science and technology and to recognize the contributions that space science and technology can make to the betterment of human condition.

Students queuing up to see INSAT Master Control Facility at Hassan during World Space Week

WORLD SPACE WEEK

The week of October 4-10 was specifically selected because it was on October 4, 1957 that the first artificial satellite of the earth, Sputnik-I, was launched and on October 10, 1967, the United Nations "Treaty on the Principles Governing the Activities of States in the Exploration and Use of Outer Space" entered into force. Since the launch of Sputnik by the erstwhile USSR, thousands of satellites have been launched for scientific research, remote sensing, communications, interplanetary probes and deep space missions. The first manned space mission led gradually to the present status of astronauts being able to work in space. Space stations and long duration stay of human beings in outer space have come within our reach.

Space activity transcends the national boundaries and demands sincere international cooperation. Outer space was therefore recognized as a common resource of human kind leading to the formation of a standing Committee on Peaceful Uses of Outer Space of the United Nations (UN-COPUOS) in 1959. The UN-COPUOS meets every year and deliberates on technical, legal and political aspects of the development of space activities of member states. The committee maintains a fine balance between various aspects and recommends to the UN General Assembly on the long term measures to be adopted. In the last 40 years of work, UN-COPUOS has created five international treaties on the subject of Outer Space. The foremost of these is 'Treaty on Principles Governing the Activities of States in the Exploration and Uses of Outer Space including the Moon and other Celestial Bodies', popularly known as the Outer Space Treaty entered into force on 10th October 1967. The Outer Space Treaty was the cornerstone for international cooperation in the outer space.

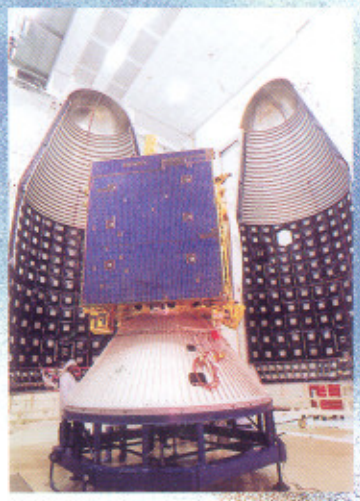
UNISPACE-III recognized the significance of the two days, the October 4, 1957 which opened mankind's access to Space, and October 10, 1967 which brought in an egalitarian Treaty into effect and most appropriately decided to celebrate October 4-10 as World Space Week.

Treaty on Principles Governing the Activities of States in the Exploration and Uses of Outer Space including the Moon and other Celestial Bodies... *Outer Space Treaty*

The exploration and use of outer space shall be carried out for the benefit and in the interest of all countries, irrespective of their degree of economic and scientific development.

The exploration and use of outer space shall be the province of all mankind. Outer space shall be free for exploration and use by all states, and is not subject to national appropriation. The parties to the treaty undertake not to place in orbit around the earth any objects carrying nuclear weapons or any other weapons of mass destruction.

GSAT-1 encapsulated assembly being integrated with the launch vehicle. (Equipment bay of the vehicle is seen in the foreground)



GSAT-1 being encapsulated in the two halves of the heatshield

Second Stage being stacked on the first stage.

First stage solid booster segments being stacked.

India's Geo synchronous Satellite Launch Vehicle, GSLV, is gettting ready for the first test flight on May 28, 2001 from SHAR Centre Sriharikota. The 401 tonne, 49 m tall GSLV is designed to place 1500-2000 kg. communication satellites into geo-synchronous transfer orbit.